

Decision I Installation Guide

Part I

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Decision I - Desk Top Model

Installation Guide

Part I

1. INTRODUCTION

This part of the manual is an introduction to your system. Part II describes the procedure for installing your disk system(s) to your Decision I.

The Decision I is a high performance, multi-user computer system designed to be flexible enough to suit the needs of a range of users - from single user systems to multi-user development stations. This compact but expandable system conforms to IEEE 696 standards for board connection. Its architecture also combines powerful hardware memory management with user-protection features to add dependability to the power and flexibility of the Decision I.

In addition to its flexibility and dependability, the Decision I is easy to install. This manual contains information that will guide you through installation. It is **important that you first read the manual, then go through again and begin the installation procedures.** The user is also referred to the technical manuals provided for further information on the Decision I.

1.1. System Requirements

The Decision I supports up to three terminals and either a Centronics or daisy-wheel style printer in its standard configuration.

The standard printer connection for the Decision I is a Diablo-style daisy-wheel printer. These printers offer high quality print at moderate speed and price and are well suited to a business environment. In systems where maximum speed is required, it is advised to purchase a serial or Centronics-style parallel line printer. Morrow Designs also supplies software programs for some of these more common printers.

The default baud rate for the operating system is 9600, (standard terminal baud rate) but most CRT terminals with an RS-232 type of interface can be connected to the Decision I, as can terminals with communication rates in the 110 to 19.2K baud range. The user is advised to obtain terminals which are suitable to his particular needs (and that meet the requirements mentioned above). The Decision I software can then be configured for the particular terminal.

1.2. System Software

The Decision I comes from the factory with a minimum of 65K of static memory and the necessary software for a 62K CP/M oriented system. Included with the system is a floppy diskette containing Morrow Design's version of CP/M for the Decision I.

Also supplied on this diskette are system utilities normally used with CP/M and Morrow Designs custom software which allows the user maximum use of the powerful hardware in the system. If your system has been configured with a Morrow Designs hard disk, all the necessary software to support this has been provided, as have diagnostic routines. (This system software is described in the appendix of this manual.)

The 8-inch system diskette supplied should be handled with caution as it contains valuable information magnetically encoded on its surface. Make a copy of this diskette, and keep the original as a backup. Store both the original and the copy in a safe, cool and dry place away from stray magnetic fields which could alter their contents.

2. SYSTEM SPECIFICATIONS

Dimensions: 48.2 X 53.4 X 22.8 cm wide
(19 X 21 X 9 inches wide)

Net Weight: 10.3 Kg. (23 lbs.)

External Power Requirements:

U.S. 115 VAC nominal (90V to 130V min/max) 60 Hz

Export 115/220 VAC nominal (198V to 242V min/max) 50/60 Hz

AC Power: 2.5 Amps @ 115 VAC (maximum)
1.25 Amps @ 220 VAC (maximum)

Internal Power Requirements:

+8 Volts @ 12 Amps (filtered)
+16 Volts @ 1.5 Amps (filtered)
-16 Volts @ 1.5 Amps (filtered)

Supply Type: Switching

Efficiency: 80% typical

CPU Specifications:

CPU Type: Z80A (NEC 780A)

CPU Speed: 4 Mhz (6 Mhz optional)

Math Processor: AMD 9512 (optional)

Memory: 65K bytes of 200 ns low power static
standard (expandable to 1 M bytes)

2K bytes of EPROM

Standard I/O: 3 Serial channels (50 baud to 56K baud)
1 DAISY printer channel
1 Multi-purpose eight-bit parallel port
(bi-directional)

Real-Time Clock: NEC 1990C

Interrupt
Controller: 8259A

Environmental Considerations:

Temperature: 10 C to 40 C (operating)
-40 C to 52 C (non-operating)

Humidity: 10 to 90%

Elevation: Sea Level to 3658 meters (12,000 ft.)

3. UNPACKING THE DECISION I

IMPORTANT NOTE: SAVE YOUR PACKING MATERIAL! The Decision I computer has been shipped from the factory in packing materials that help prevent damage to the computer due to rough handling. If you need to return the unit to Morrow Designs, it **must** be packaged in its original factory shipping container to qualify for service under warranty. Repacking the computer in its original container provides the best protection during shipment.

- Enclosed in your box is a list of contents of the system you have ordered. This list contains the serial numbers of all devices in your system. Please check the contents of the container to verify all components have been received. Most systems have more than one shipping box but the Decision I box always contains the total system contents document. Please file this away with your records for future reference.
- Remove all the system documentation and the AC power cord from the container.
- Carefully lift Decision I enclosure from shipping container and remove from foam packing material.
- Place Decision I on a flat surface and inspect cabinet for any signs of shipping damage.
- Disk drives are shipped in separate containers and contain all the cables needed to connect them to the Decision I rear panel.

4. SYSTEM INSPECTION

WARNING: The Decision I computer system contains hazardous voltages inside. Extreme care should be taken when installing cables and components within this system. The cover should be removed only after the AC power cord has been disconnected to prevent electrical shock.

As shipped from the factory, all connectors internal to the Decision I cabinet are in place. There are two connectors on the Wunderbuss I/O motherboard which should be checked, though:

P6 - Power (board location 1C)
J6 - Reset (board location 8E).

Check to make sure the cables have not been jarred loose during shipping. Also check that none of the S-100 plug-in modules inside the cabinet have been loosened as well.

5. CONNECTOR ORIENTATION

Connections to the Decision I are made with ribbon cable connectors. Refer to Figure 5-1 for the placement of these cables. When making these connections, take care not to bend the pins or damage the connectors.

5.1. "D" Style Connectors

These connections are simplified because of their "D" shape. Simply match the connector to the pin connection socket.

The main console device in the Decision I is always connected to the right-most 25-pin "D" style connector labeled SERIAL PORT 1 in the figure. (Refer to the installation instructions for your particular terminal to connect this device.)

(NOTE: The pinout for this 'D' connector is detailed in the Wunderbuss I/O manual (Section 6, page 20). If you require wire connection for operation with your CRT terminal, simply connect (tie) pins 1, 2, 3 and 7 to the matching pins of the CRT terminal and the interface should be complete.)

The connectors to the left of this (SERIAL PORTS 2 and 3) are for the second and third CRT terminals in multi-user systems, or for a second terminal and a serial printer. (The Wunderbuss I/O board also offers hardware handshaking for serial device connection. Refer to the Wunderbuss technical manual, Section 6, pages 20 - 21, for a description of the pin arrangement.)

To left of SERIAL PORT 3 is a 15-pin AUXILIARY PARALLEL PORT, which may be used to connect a Centronics-style parallel printer. (Again, refer to the installation instructions for your printer before making this connection.)

5.2. 20- and 50-pin Connectors

Above the serial connections are two 20-pin data cable connections for the hard disk; above these are three 50-pin connections for the hard disk, floppy disk and daisy-wheel printer. These connections are not as straightforward as the "D" style connectors.

Connection for the daisy-wheel printer is correct if the ribbon leads downward. Connecting the end of this cable may take a bit of "trial and error." Try the connection one way; if it does not work, turn the connector around and try it again.

To connect the disk systems, carefully read the instructions in Part II of this manual and note that **the cables have been constructed so that the ribbons usually lead downward when properly connected.** Refer to Figure 5-1 for the location of these connectors.

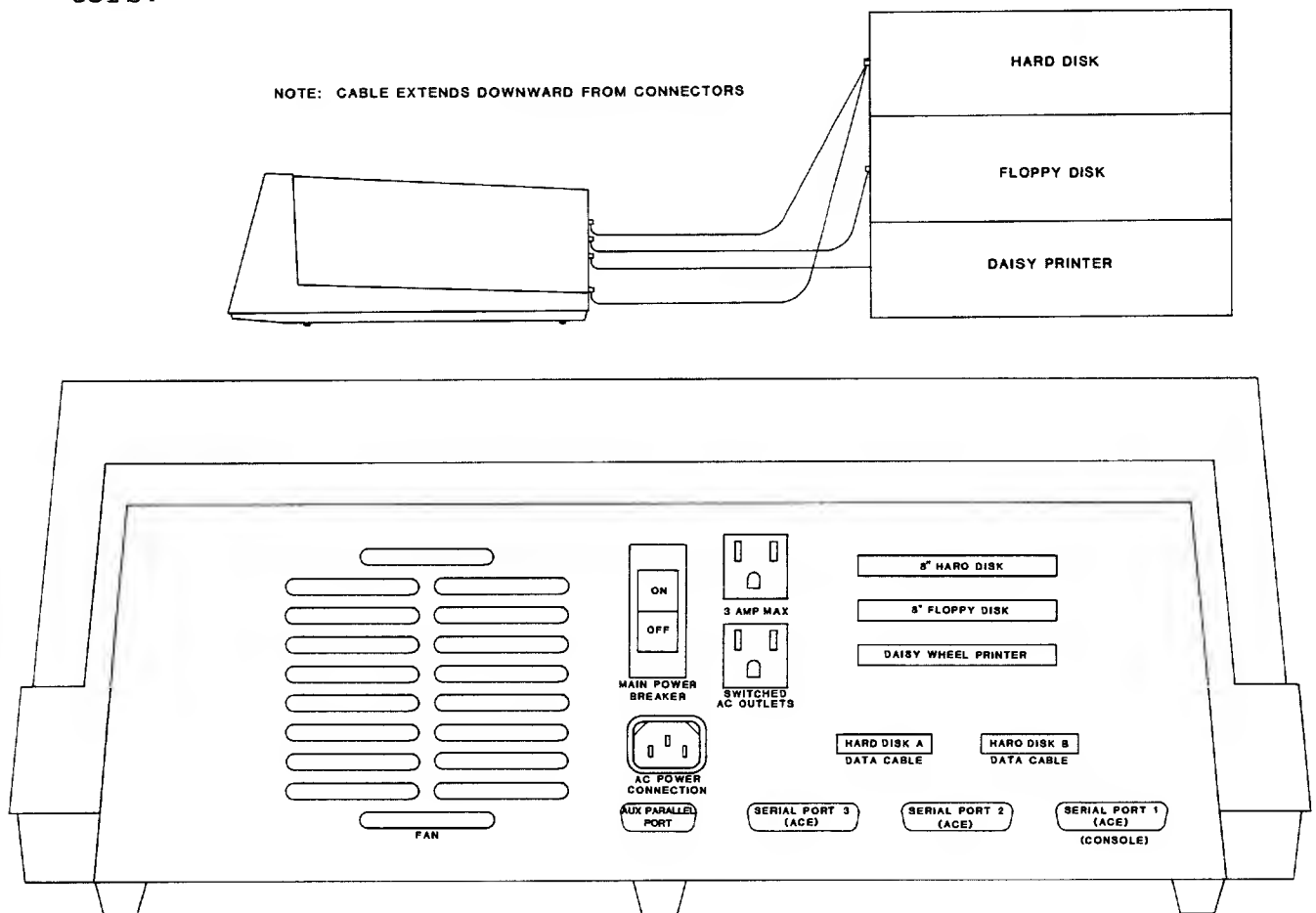


Fig. 5-1: Decision I Back Panel - Rear View

5.3. Power Connections

The Decision I Desk Top computer requires 115 volts at 2.5 amps (maximum) for operation. There is an AC power receptical that mates with the supplied AC power cord on the rear panel. Simply plug the cable into the receptical and the system is ready to be used. (Do not connect the power cables, however, until you are satisfied that all connections are properly made.)

The Decision I also has provisions on the rear panel for plugging in the peripheral devices. These AC utility outlets are switched by the main power button on the rear panel of the Decision I and have a maximum combined capacity of 5 amps. You may use these to connect the CRT terminal and disk drives.

5.4. Circuit Breaker Protection

The main power button on the rear panel provides both power ON, OFF and circuit breaker protection. In the unlikely event of system or peripheral failure, the circuit breaker trips (switches to the middle position) preventing further damage to the components or peripheral devices. This circuit breaker is rated at 5 amps and trips when the AC power draw exceeds this limit. Upon tripping, power will not be supplied until the breaker switch is thrown to the full OFF position, then returned to the ON position. However, any time the breaker does trip, first investigate the conditions which caused the overload and remove them before re-applying power.

6. SYSTEM MAINTENANCE

The Decision I requires no special maintenance under normal operation. The cabinet is constructed of a highly durable plastic impervious to stains and dirt. If required, the cabinet may be cleaned with a mild detergent and water and a non-abrasive cloth. Internal components need no special maintenance.

Failure of any Decision I system component during the warranty period not due to abuse or neglect is covered under the standard Morrow Designs warranty and the customer is referred to his supplier for service. (See also Morrow Designs' warranty and return policy.)

Decision I Installation Guide

Part II

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Decision I - Desk Top Model

Installation Guide

Part II

1. INTRODUCTION

This section describes the installation of Morrow Designs' Discus series of disk storage units to the Decision I. Connection of your printer and terminals should be fairly straightforward. Refer to the installation material included with these devices if you encounter any problems.

At this point there are probably several large, empty boxes strewn about you and various computer components are waiting on a table to be connected to your Decision I.

If you have read Part I of this manual, you are now familiar with all the external cable connectors, buttons and plugs on your system. (If you aren't, go back and read Part I.)

As in the first section, it is suggested you read over these instructions first, then return to this section and begin the installation procedures.

Before beginning any actual plugging in and cabling, make certain you are clear about what type of disk storage unit you have: For example, do you have an M20 hard disk unit with a single Discus floppy diskette storage unit as a backup? Perhaps you have only a double Discus floppy diskette storage system and no hard disk unit at all. (If you have are installing units other than those sold by Morrow Designs, you should probably check out the INSTALL.COM program included on the system diskette. This program is also described briefly in the appendix of this manual.)

The installation instructions have been separated into two sections - the floppy diskette units are described first. If you are installing both a floppy and hard disk system, be sure to read through both sections!

One other important thing to mention here: Find the black CP/M 2.2. Manual in your pile of system documentation and keep it handy. You will probably need to refer to it at some point during installation.

Now, take a deep breath. Let it out and get going. Enjoy your new system!

2. DISK SYSTEM SPECIFICATIONS

This section is a general overview of the specifications for the Discus disk storage units. Detailed specifications on these systems may be found in the literature supplied by the manufacturers.

2.1. Floppy Disk Systems

The Discus single and double disk drive are manufactured by the Shugart Corporation. Both diskette storage devices (series SA 800 and 850) read and write in single or double density on standard diskettes. Both are also media compatible with IBM 3740 and S/32 single-sided drives as well as the IBM 4964 and 3600 series of two-sided units.

2.2. Hard Disk Systems

The Discus M10 and M20 are sealed Winchester hard disk drives manufactured by the Fujitsu Corporation.

The M10 contains two 8-inch disk platters and has a formatted storage capacity of 10 megabytes.

The M20 contains four 8-inch disk platters and has a formatted storage capacity of 20 megabytes.

The M26 is also a sealed Winchester hard disk. It contains two 14-inch disk platters and has a formatted storage capacity of 26 megabytes. Its drive component is made by Shugart (series SA 4008).

3. DISK CONTROL HARDWARE

This section describes the hardware interface between the disk drives and the Decision I. Detailed information may be found in the technical reference manuals for these products.

3.1. Floppy Disk Controller

Hardware interface between the floppy disk drives and the Decision I is accomplished by the Morrow Designs Disk Jockey 2D/B (DJ2D/B) controller board. This board is compatible with any 8080, 8085 or Z80 Central Processing Unit (CPU) that operates in the 1.5 Mhz to 5 Mhz range. The DJ2D/B conforms to IEEE 696 standards for S-100 bus termination.

3.2. Hard Disk Controller

Hardware interface between the hard disk drive and the Decision I is accomplished by the Morrow Designs Winchester Hard Disk Controller (HDCA-3) board. This board is also compatible with any 8080, 8085 or Z80 CPU and conforms to IEEE 696 standards for S-100 bus termination.

4. UNPACKING AND INSPECTION - FLOPPY DISKETTE SYSTEMS

Carefully remove the Discus floppy disk from the shipping container. Save the packing material. If it is necessary to return any equipment, it must be returned in the original box.

Inspect your equipment before installing it. This includes checking the serial number tag to be sure the voltage and frequency requirements correspond to your power source and that the system floppy diskette supplied for initializing your system matches your system configuration.

4.1. Single floppy disk systems are shipped with a piece of foam rubber inserted into the door opening to prevent damage to the head mechanism. Remove the foam and check that no damage is evident.

4.2. Double floppy disk systems are shipped with the doors latched shut and a cardboard shipping disk inserted in the slots to prevent damage to the head mechanisms. Remove the latches and the cardboard disks. Now, get inside the unit (see instructions for Internal Inspection below) and remove the screws and wellnuts that are stabilizing the drives. (A manufacturer's Unpacking Instructions sheet should be included with your unit. This sheet clearly depicts these procedures.)

5. REPACKING INSTRUCTIONS

If you must move or ship back your floppy diskette storage system, repack the system as it was originally packed. Replace the foam rubber into the door of the single floppy unit. Replace the cardboard diskette, door latches and screws on the double floppy unit.

Instructions for returning damaged or defective equipment are given in the Warranty Return Procedure sheet at the beginning of this manual.

6. INTERNAL INSPECTION

The floppy diskette storage units are shipped from the factory set for normal operation. If for some reason you must check these settings, (the drive does not work properly or you want change the drive locations, for example), you must manually adjust various jumpers and switches. To do this, you must remove

8. INSTALLATION PROCEDURES

- Turn off power to computer.
- This would be a good time to double check switch settings. The factory settings for this board are described in Appendix D of this manual.
- If not already done, install the DJ2D/B pc board into the Wunderbuss I/O motherboard. Press board into (any) slot GENTLY, but firmly.

The following instructions are given from a rear view orientation of the Decision I system (refer also to Figure 5-1 in Part I):

8.1. Internal Connections

1. Locate the 50-pin connector on the top-left side of the DJ2D/B board.
2. Locate also the internal 50-pin ribbon cable extending from the connector labeled 8" FLOPPY DISK in the figure. Connect this cable to the 50-pin connector on the DJ2D/B. Connection is correct if ribbon leads down and toward the back panel. Connection is incorrect if ribbon leads away from back panel.

8.2. External Connections

1. Connect a 50-pin ribbon cable to the external 50-pin connector labeled 8" FLOPPY DISK. Connection is correct if ribbon leads downward from connector.
2. Connect the other end of this cable to the 50-pin connector on the left side of the Discus floppy disk system rear panel. This connector has been installed vertically; there is only one way the connection can be made.

8.3. Connection Test

Test your connections now. Turn on power to the Decision I by pressing the top portion of the POWER switch down. Turn on power to the Discus system by flipping the toggle switch on the right side of the rear panel up.

Go to the front of the systems now and check for the following:

- The red RESET button on the Decision I is lit. Press this button to insure proper system initialization.
- The red indicator light on the the Discus system is blinking. (On the Discus double floppy system, the indicator light on the left side of the system should be blinking.)

If the indicator light is lit (not blinking), and pressing the RESET button does not turn it off, you have made an improper cable connection. Turn power to both systems off before going any further.

First try correcting the connection by unplugging ONLY the 50-pin external connection to the 50-pin connector labeled 8" FLOPPY DISK. Turn the ribbon cable connector over and re-connect it.

Turn power to both systems on and go over the above check again. If the system still does not power up correctly, make sure that you followed previous connection instructions correctly. A troubleshooting chart follows at the end of this manual; check this out, too.

If you are satisfied that all connections are made properly, but are still unable to get your system to operate correctly, contact the Customer Service Center.

9. INITIALIZING THE FLOPPY DISK

At this point it is assumed that your floppy disk system has been properly powered up. This is indicated by the blinking red light on the front of floppy disk drive. To initialize, or "boot" your system now, insert the system diskette into the drive, label facing up and away from the door. You will hear some activity within the drive, then the following message appears on your terminal CRT:

Morrow Designs nnK CP/M 2.2., Cbios, Rev. 2.nn

The number (n) is determined by your system configuration. There will also be information describing your disk drive, console and printer. Immediately after this message, the CP/M prompt appears

A>

indicating you have successfully "booted" your system.

If you have a Morrow Designs Discus M10, M20 or M26 hard disk unit, you are only partially finished with this installation. If, however, you do not have a hard disk unit, you are finished installing your floppy diskette storage unit.

10. UNPACKING AND INSPECTION - HARD DISK SYSTEM

Carefully remove the hard disk unit from the box. (NOTE: If you have a Discus M26 hard disk unit, there should be three boxes - carefully read the Assembly Instructions found in the small box before unpacking your hard disk.) Save the packing material. If it is necessary to return any equipment, it must be returned in the original container.

Inspect the equipment before installing it. This includes checking the serial number tag to be sure the voltage and frequency requirements correspond to your power source and that the system floppy diskette supplied for initializing your system matches your system configuration.

10.1. The M10 and M20 hard disk storage units are locked in place for shipping. To unlock the heads, use a Phillips screwdriver to remove the three screws on the front cover, remove the cover, then find the LOCKED and UNLOCKED label on the drive. There is a lever underneath this label. Unlock the drive by switching this lever to the UNLOCKED position. The lever is held in place in two notched areas. Hold the lever down, pulling it out of the first notched area marked LOCKED, then slide it across and up to the second notched area marked UNLOCKED.

NOTE: If the above procedure does not fully unlock the disk, it may be necessary to manually unlock it. Do this by tilting the unit, cover end down, then rocking it GENTLY back and forth two to three times.

10.2. The M26 hard disk storage unit is locked in place with both a spindle screw and a "U" shaped lock device. This "U" shaped device MUST NOT be removed from the drive until it is running at full speed. This cannot be done, however, until the spindle screw has been removed. In fact, failure to remove this screw will cause the drive motor to burn up (and void your warranty). Remove this screw during assembly, as described in the Assembly Instructions guide.

11. REPACKING THE DRIVES

If you must move or ship back your hard disk storage system, repack the system as it was originally packed. Make sure the head is at track 0. Replace all screws and latches and make sure the heads are locked (M10 and M20 back in LOCKED position.)

The M26 is locked by first running the drive up to full speed, then re-inserting the "U" shaped lock device. After power is shut off, re-insert the spindle screw.

If damage is evident, follow the above instructions as well as the instructions given on the Warranty Return Procedure sheet at the beginning of this manual to return your equipment.

12. INTERNAL INSPECTION

The hard disk units are shipped from the factory set for normal operation. The standard configuration for the Decision I is one hard disk. Additional hard disk drives may be installed but require a custom-written software program.

If for some reason you need to change or inspect the internal settings for the hard disk units, you must get inside the unit. Make sure power all power is turned off to the system, then use a Phillips screwdriver to undo the cover screws.

The control boards for the 8 inch hard disks are fairly easy to locate. The control boards for the 14 inch hard disks, however, are stacked. Remove the top board by locating the nylon wing clips at the center of the board, then pressing this clip in and gently lifting the board.

Typical layouts of these drive control boards are shown in Figure 12-4 and 12-5. Use these figures to check the following settings:

Table 12-1: Fujitsu M10 and M20 Hard Disk Units

Standard Jumpered Settings

S1 - 2 to 3
S2 - 2 to 3
S3 - 2 to 3

Standard Bit Settings

MSB			LSB		
OFF	ON		OFF	ON	
==		1	==		1
==		2	==		2
	==	3		==	3
	==	4		==	4
==		5		==	5
==		6	==		6
	==	7		==	7
==		8		==	8

Table 12-1, Cont.

Factory Switch Settings

Switch 3			Switch 4		
OFF	ON		OFF	ON	
	==	1	==		1
	==	2	==		2
==		3	==		3
	==	4	==		4
==		5	==		5
==		6	==		6
==		7	==		7
	==	8	==		8

Table 12-2: Shugart M26 Hard Disk Unit

Standard Jumpered Settings (26058)

DS1 T
IX E
RY SC
ST S2
SL R

Standard Bit Settings (26058)

OFF	ON	
	==	1 LSB
	==	2
	==	3
	==	4
==		5
==		6
	==	7
	==	8
	==	9
==		10
	==	11
	==	12

Table 12-2, Cont.

Standard Jumpered Settings (26029-3)

IX	T
SL	SC
RY	S2
ST	R
DS1	DE

Standard Bit Settings (26029-3)

OFF	ON		OFF	ON	
	==	1		==	9
	==	2	==	==	10
	==	3		==	11
	==	4		==	12
==		5			
==		6			
	==	7			
	==	8			

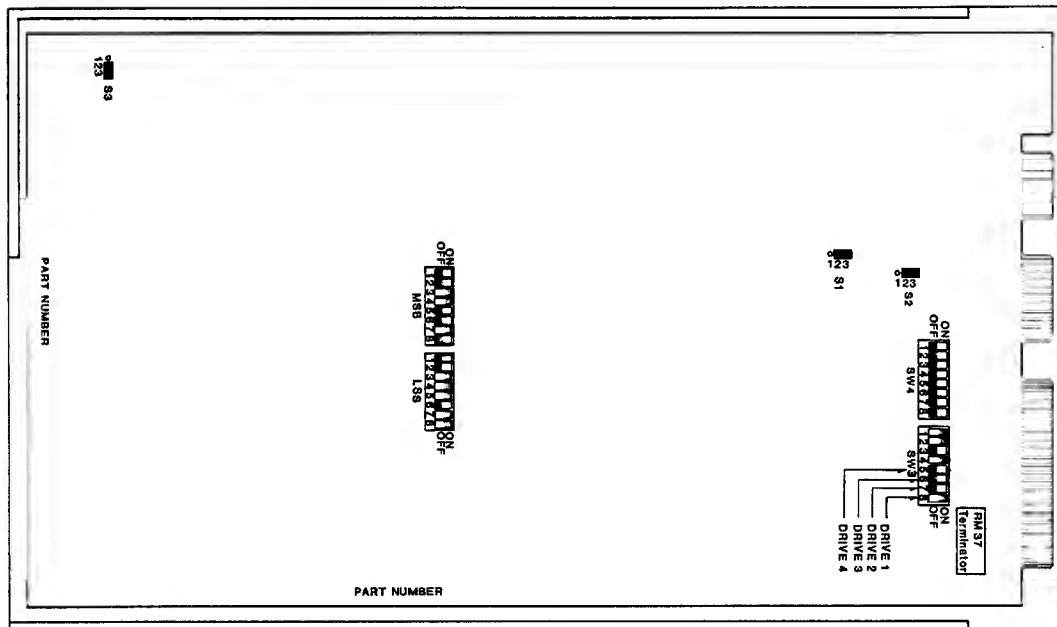


Fig. 12-1: Fujitsu 8" Hard Disk Control Board

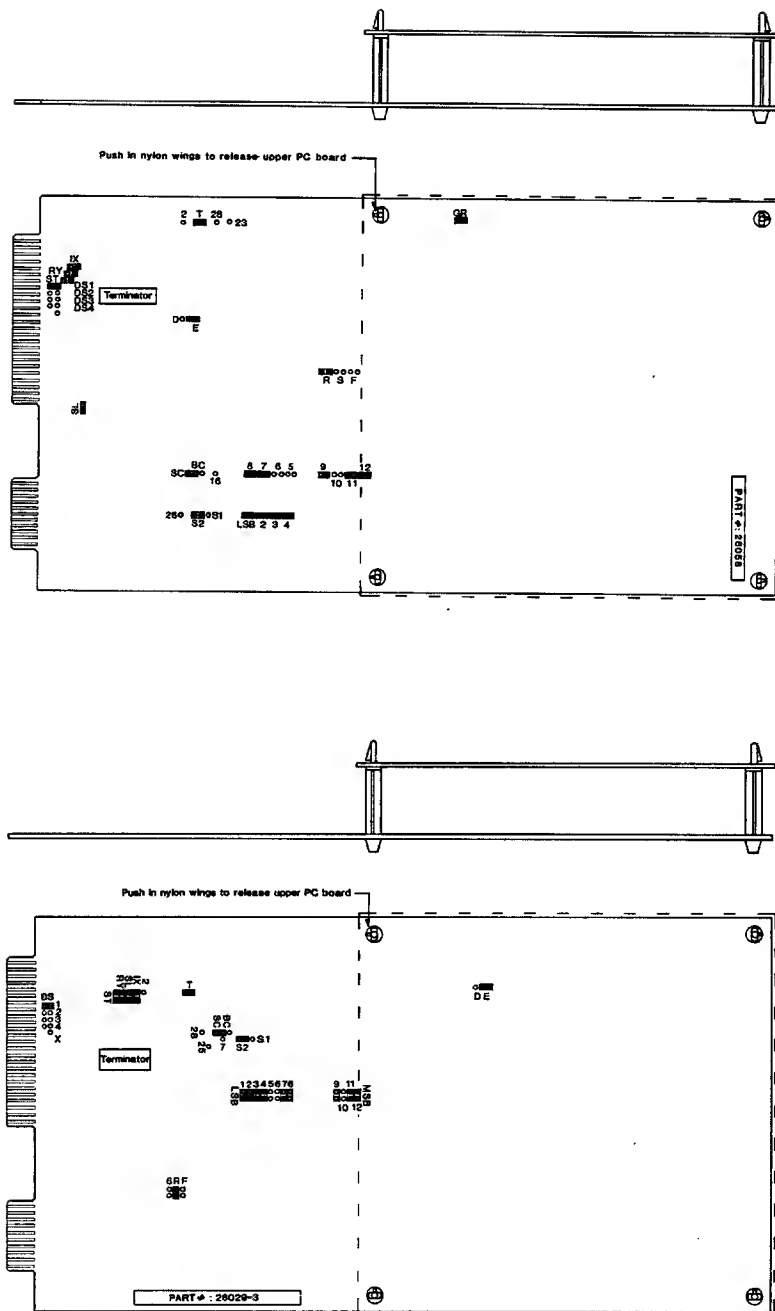


Fig. 12-2: Shugart 14" Hard Disk Control Boards

13. INSTALLATION PROCEDURES

- Turn off power to computer.
- This would be a good time to double check the switch settings. The factory settings are described in Appendix D of this manual.
- If not already done, install the HDCA - 3 pc board into the Wunderbuss I/O motherboard. Press board into (any) slot GENTLY, but firmly.

The following instructions are given from a rear view orientation of the Decision I system and Discus units (refer also to Figure 5-1 in Part I):

13.1. Internal Connections

1. Locate the 50-pin connector on the top-left side of the HDCA - 3 pc board and the 20-pin connector to the right of it.
2. Locate also the internal 50- and 20-pin ribbon cables extending from the connectors labeled 8" HARD DISK and HARD DISK A - DATA CABLE. Connect the 50-pin cable to the 50-pin connector on the HDCA -3. Connect the 20-pin ribbon to the 20-pin connector on the HDCA - 3. Connections are correct if the ribbons lead down and toward the back panel. If the ribbons lead away from the back panel, you have made an incorrect connection.

13.2. External Connections

1. Connect a 50-pin ribbon cable to the external 50-pin connector labeled 8" HARD DISK in the figure.
2. Connect the other end of this cable to the 50-pin connector on the right side of the Discus hard disk rear panel. Connections are correct if ribbon extends downward from the connectors.
3. Connect a 20-pin ribbon cable to the external 20-pin connector labeled HARD DISK A - DATA CABLE in the diagram.
4. Connect the other end of this cable to the 20-pin connector on the left side of the Discus hard disk system rear panel. Again, connections are correct if ribbon extends downward from the connectors.

14. TESTING THE HARD DISK

This section explains the procedure for testing your hard disk. It is assumed at this point that your floppy disk unit is properly installed.

Even though your hard disk was tested at the factory before being sent to you, it must undergo another diagnostic test to be sure that no head alignment problems occurred during shipping. This test takes six to 14 hours, depending upon the size of your disk. In order for the test to begin successfully, the first two tracks (0 and 1) of the hard disk must be error free. Consequently, if an error exists in either of these tracks, the unit will not function. (If you suspect that this is a problem in your unit, contact the Customer Service Center.)

The first test run is the FORMATHD program. It is included on your system floppy diskette and is called by entering

```
A> formathd
```

at the terminal. (Note that the system is in the CP/M mode; please also allow time for your hard disk to "get up to speed" before beginning this test.) Correct entry results in the following display on your video display screen:

```
Discus M10, M20 and M26 hard disk format program, Rev. 2.1.  
Choose the desired function:
```

```
L = format a Logical drive.  
F = Format an entire physical drive.  
C = Continue an interrupted test.  
D = run a Diagnostic test.
```

```
Function (RETURN to exit):
```

To begin the diagnostic test, enter D, then press RETURN. This program now prompts:

```
How much of a diagnostic do you want to run:
```

```
1 = Sector header field test only.  
2 = Sector data field test only.  
4 = Seek mechanism test only.
```

Choose the diagnostic by adding together the desired options.

```
Options (RETURN to exit):
```

Option sum is 7 - all diagnostics are run. Enter 7, then press RETURN. The next prompt asks for the following information:

```
Enter physical drive number to be tested or formatted (1-4,  
RETURN to exit):
```

In this configuration, one drive is tested. Enter 1, then press RETURN. Now,

Select the drive type:

A = Discus M26, 26 megabyte drive.
B = Discus M10, 10 megabyte drive.
C = Discus M20, 20 megabyte drive.

Drive type (RETURN to exit):

Enter A, B or C, depending upon your hard disk unit, then press RETURN.

The first areas tested are the sector headers. This is evidenced by the following display:

Testing sector headers.....
.....

The test has begun. For the next six to 14 hours information of this sort is displayed on the video display screen. As each test is completed, new descriptions are displayed such as "Seek test" or "Testing sector data." Error information is also displayed, if errors are found. Their displays resemble the following example:

SECTOR ERR, TRACK 233, HEAD 0, SECTOR 2, COUNT 189

Error information is recorded by the system. Bad sectors, including sectors that are diagnosed as marginal by the test, are "mapped" (effectively blocked) out of the hard disk.

When the test is finished, the results are placed in a special file created by three routines used within a program designed to map out bad sectors. This procedure is explained in Appendix E.

15. INITIALIZING THE HARD DISK

At this point your system diagnostic tests should be complete. If so, the next step is to initialize the hard disk. It is best to describe this procedure from a "cold boot." If your system is on, shut it off, then follow these steps:

- A. Turn on power to the Decision I.
- B. Turn on power to the Discus floppy disk unit.
- C. Turn on power to the Discus hard disk unit by pressing the right side of the POWER button down.
- D. Check that the red RESET button on the Decision I front panel is lit. Press this button in ONCE to insure proper system initialization.
- E. Check that the red indicator light on the Discus floppy disk unit is blinking.
- F. Insert the system floppy diskette - label side up and away from the slot, and close the door.

At this point you will hear some activity within the floppy disk system, then the following message appears on your display screen:

```
Morrow Designs nnK CP/M 2.2., Cbios, Rev. 2.nn
```

The full revision number depends on your system configuration. Information describing your disk drive(s), console and printer configuration is also displayed. Immediately after this, the CP/M prompt appears:

```
A>
```

indicating that you have successfully "booted" your floppy disk unit. Now it is time to initialize the hard disk. Once again call the FORMATHD program:

```
A>formathd
```

And once again you will see the following display on your terminal screen:

```
Discus M10, M20 and M26 hard disk format program, Rev. 2.1.  
Choose the desired function:
```

- L = format a Logical drive.
- F = Format an entire physical drive.
- C = Continue an interrupted test.
- D = run a diagnostic test.

```
Function (RETURN to exit):
```

This time enter F to format the physical drive. Press RETURN.
The next prompt is

Enter physical number to be tested or formatted (1-4, RETURN
to exit):

Enter 1 and press RETURN. Next the program asks

Select the drive type:

A = Discus M26, 26 megabyte drive.
B = Discus M10, 10 megabyte drive.
C = Discus M20, 20 megabyte drive.

Drive type (RETURN to exit):

Enter A, B or C, depending upon your hard disk unit, then press
RETURN. If you have an M10, the system will prompt:

Select drive type:

F = Fujitsu
M = Memorex

Type (RETURN to exit):

Enter F, then press RETURN. For all Discus users, the system now
prompts:

Enter amount of formatting desired:

H = Format Headers only (data remains intact)
D = Erase Data field also

Function:

Enter D and press return. The system now tells you that

Formatting the entire physical disk will take about four
minutes.....
.....
.....
.....

At the end of that time, it says

All finished, returning to CP/M
Press RETURN to return to CP/M:

Press RETURN, and the CP/M prompt reappears.

15.1. Bad Sector Check

To check out the hard disk system, enter the GETBAD command:

```
A> getbad
```

This program displays any errors - such as TRACK, HEAD and SECTOR - along the left side of the screen. When the CP/M prompt appears again, use the FIXBAD program to create a bad sector map (refer also to Appendix E). Enter the FIXBAD program in the following format:

```
A> fixbad e f g*
```

*Enter g only if you have an M20 or M26. FIXBAD reads a "bad spot" map, if one has been created by the FORMATHD program, and allocates it to an "invisible" file, thus protecting CP/M from access to these spots. Once this program is finished, you are ready to install your system on the hard disk.

15.2. Installing the System

First enter the MOVCPM command using the following parameters:

```
A> movcpm nn *
```

The number (nn) is determined by the size of your system; this should be noted on your system diskette. You may also enter:

```
A> movcpm * *
```

to install the largest system your computer is capable of. Next install the operating system. Call

```
A> sysgen
```

This program returns with the following prompts:

```
SYSGEN VER. 2.2  
SOURCE DRIVE NAME (OR RETURN TO SKIP)
```

Press RETURN. Next it prompts:

```
DESTINATION DRIVE NAME (OR RETURN TO REBOOT)
```

This time enter E and press RETURN; it now prompts

```
DESTINATION ON E, THEN TYPE RETURN.
```

Follow these instructions. Once the CP/M prompt reappears, you are ready to move the system files onto your hard disk. Here you will use the CP/M PIP command:

```
A> PIP E:=*.*[v]
```

You should hear some activity and see the light go on under the floppy disk slot. PIP will also write the files it is transferring for you on your screen. Once this procedure is complete, you will be ready to boot your hard disk. Enter:

```
A> boothd
```

press RETURN, and the following message appears.

```
Morrow Designs nnK CP/M 2.2., Cbios rev 2.nn
(system configuration)
Decision I configured as console.
```

Use the CP/M directory command now to check that your drives are properly formatted. This command should have the following results (see Appendix A for list of system files):

```
A> dir
list of system files on hard disk

A> dir b:
no files

A> dir c:
list of system files from floppy disk unit (M10 only)

A> dir d:
list of system files from floppy disk unit (M20 and M26)

A> dir e:
no files (M20 and M26 only)
```

15.3. Cold Boot

Follow steps A - F outlined at the beginning of this section. Once the initial header and CP/M prompt (A>) have appeared, simply enter **boothd** after the prompt, press RETURN, then watch for the second header and the CP/M prompt again. You should be up and running!

15.4. Warm Boot

If your system is already on and it is necessary to reboot, (usually done when copying diskettes in the CP/M program) simply enter a control C (^C) sequence.

Occasionally, the CP/M prompt changes to a : (this may happen upon reset and sometimes when the system is first initialized). If this prompt appears, enter a single **b** after the prompt; do not press RETURN. The system should automatically change the prompt back to A>.

15.5. Booting From the Hard Disk

In systems that have been set up to boot from the hard disk, all that you need do is turn on the power and press the RESET button. This is done by setting switches on the MPZ80 CPU board. These settings are described in Appendix D of this manual. The settings and procedure are also described on page 15 of the **MPZ80 CPU Technical Manual**.

Enjoy your new system! (A troubleshooting chart follows this section and some very helpful appendices follow after that.)

16. TROUBLESHOOTING THE DECISION 1

The following table has been designed to aid you in the event the Decision I does not operate correctly:

PROBLEM	PROBABLE CAUSE	REMEDY
FLOPPY DISK		
FAN OFF, POWER INDICATOR NOT LIT:	Power cord not plugged in.	Plug in cord.
	Power cord not plugged into rear panel of system.	Plug in cord.
	Wall outlet not live.	Check outlet. Check circuit breaker.
	Main circuit breaker has tripped.	Check system for shorts; turn breaker OFF, then back ON.
FAN ON, POWER INDICATOR NOT LIT	Indicator light bad.	Replace indicator light.
	Internal connection loose.	Contact service center.
	Power supply connection loose.	Contact service center.
POWER ON, BUT DISK DRIVE INDICATOR LIGHT DOES NOT BLINK:	Disk drive not plugged in.	Plug it in.
	Power cord not plugged in.	Plug it in.
	Floppy disk drive breaker switch not ON.	Turn it ON.
	Circuit breaker on disk drive rear panel tripped.	Check connections for shorts; turn breaker OFF, then back ON.

PROBLEM	PROBABLE CAUSE	REMEDY
DISK DRIVE INDICATOR LIGHT DOES NOT BLINK	50-pin cable not connected correctly.	Plug it in. (See Section 8)
	System was not RESET.	Push RESET button on front panel.
DRIVE HEAD LOADS, SEEKS, BUT SYSTEM DOES NOT POWER UP:	Floppy diskette inserted incor- rectly.	Insert diskette with label facing up and away from slot.
	Incorrect diskette in- serted.	Insert diskette with Morrow Designs label- refer to Section 9.
	Cables and plugs incorrectly connected.	Refer to Sec- tion 8.
SYSTEM LOADS WITH GARBLED MESSAGE:	Baud rate or word setting incorrect.	Refer to Appen- dix C.
HARD DISK		
DRIVE DOES NOT INITIALIZE	Data or control cable connected incorrectly.	Methodically change cable connections.
	Power supply con- nection loose.	Contact service center.
	Drive head not unlocked.	Unlock head.

APPENDIX A

CP/M Software

Over 30 software programs are included on the system diskette. These may be displayed with the CP/M DIR command:

MOVCPM	COM : ABOOT&	ASM : ASM	COM : BAD	DOC
BAUD	COM : BAUD	DOC : BIOS	ASM : BOOTHHD	ASM
BOOTHHD	COM : CBIOS&	ASM : CBIOS	ASM : DDT	COM
DEBLOCK	ASM : DISKDEF	LIB : DUMP	ASM : DUMP	COM
ED	COM : FIXBAD	COM : FORMATHD	ASM : FORMATHD	COM
FORMAT#	ASM : FORMAT#	COM : GETBAD	COM : HDFIRM	ASM
HTYP	ASM : HTYP	PRL : LOAD	COM : INSTALL	COM
INSTALL	DOC : MAKEPRL	COM : MAKEPRL	DOC : MBASIC	COM
NOTESHD	DOC : PIP	COM : PRL	DOC : PUTBAD	COM
REGEN	ASM : REGEN	COM : SINGLE	ASM : SINGLE	COM
STAT	COM : SUBMIT	COM : SYSGEN	COM : XSUB	COM

Fig. A-1: System Directory (Hard and Floppy Disk System)

MOVCPM	COM : ABOOT&	ASM : ASM	COM : BAUD	COM
BAUD	DOC : BIOS	ASM : CBIOS&	ASM : CBIOS	ASM
DDT	COM : DEBLOCK	ASM : DISKDEF	LIB : DUMP	ASM
DUMP	COM : ED	COM : FIRMB	ASM : FORMAT#	ASM
FORMAT#	COM : HTYP	ASM : HTYP	PRL : LOAD	COM
INSTALL	COM : INSTALL	DOC : MAKEPRL	COM : MAKEPRL	DOC
MBASIC	COM : NOTESHD	DOC : PIP	COM : PRL	DOC
REGEN	ASM : REGEN	COM : SINGLE	ASM : SINGLE	COM
STAT	COM : SUBMIT	COM : SYSGEN	COM : XSUB	COM

Fig. A-2: System Directory (Floppy Disk System Only)

APPENDIX B

Program Descriptions

ABOOT&.ASM	Source code for cold boot section of CP/M configured for Morrow Design hardware.
ASM.COM	CP/M command; assembles 8080 assembler source.
*BAD.DOC	Describes the routines used to read and write bad sector maps from the hard disk and place them in special file.
BAUD.COM	Commands to change the baud rate on the Decision I Wunderbuss or Mult/IO boards.
*BAUD.DOC	Instructions for BAUD.COM
BIOS.ASM	Skeletal BIOS (basic I/O system) supplied by Digital Research.
BOOTH.D.COM	Command to boot Discus hard disk.
BOOTH.D.ASM	Source code for BOOTH.D.COM
CBIOS.ASM	Digital Research supplied CBIOS configured for Intel MDS-800.
CBIOS&.ASM	Source for CBIOS configured for Morrow Designs hardware.
DDT.COM	CP/M command; Dynamic Debugging Tool which allows interactive testing of programs generated in CP/M environment.
DEBLOCK.ASM	CP/M command; source for sector deblocking subroutines.
DISKDEF.ASM	CP/M source for macro expansions of disk definitions.
DUMP.COM	CP/M command; types contents of disk files at the console in hexadecimal form.
DUMP.ASM	Source code for DUMP.COM
ED.COM	CP/M command; calls context editor to create and alter source files.
FIXBAD	Allocates the bad sector map to a special file (USER 15).
FORMATHD.COM	Commands to format and test Discus hard disk systems.

FORMATHD.ASM	Source code for FORMATHD.ASM
FORMT#.COM	Command to format diskettes on DJ2D/B.
GETBAD	Reads the bad sector map from the hard disk.
INSTALL.COM	Command to temporarily add devices onto CP/M system. Uses: HTYP - Diablo printer driver simulator.
*INSTALL.DOC	Documentation for INSTALL.COM.
LOAD.COM	CP/M command; converts Intel hexadecimal format files to command format files.
MBASIC.COM	Microsoft's BASIC-80, Rev 5.2.
MOVCPM.COM	CP/M command; changes CP/M system size.
*NOTESHD.DOC	Descriptions and examples of commonly used files in the hard disk system.
PIP.COM	CP/M command; Peripheral Interchange Program used to transfer files between selected I/O devices.
PUTBAD	Allows user to make a custom bad sector map.
REGEN.COM	Converts non-1791 format diskettes to that format.
SINGLE.COM	Turns single drive system into "logical" dual drive system for copying diskettes.
SINGLE.ASM	Source code for SINGLE.COM.
STAT.COM	CP/M command; provides statistical information about files and disks.
SUBMIT.COM	CP/M command; runs commands in batch mode.
SYSGEN.COM	CP/M command; reads or writes reserved CP/M system tracks.
XSUB.COM	CP/M command; allows submitted commands to receive input from submit file.

CP/M commands are described in more detail in the **CP/M 2.2 Manual**. Program descriptions of many of these files also exist on the system diskette.

*These files may be printed out in either the CP/M or Wordstar program.

APPENDIX C

Alternate Baud Rate Selection

The Decision I is shipped from the factory with the terminal baud rate set at 9600. The serial channels are set for 1 start bit, 2 stop bits, 7 data bits, no parity.

The following baud rates are also available, if your system requirements demand this.

19200, 9600, 4800, 2400, 1200, 300 and 110

Software selection of alternate baud rates is provided with the BAUD.DOC program included on the CP/M diskette. This program describes the commands and procedures for baud rate selection. See also the technical manual for the Wunderbuss I/O controller board - Appendix B of this manual describes the switch settings for these alternate baud rates.

APPENDIX D

Factory Switch Settings

The factory configuration for the Decision I Desk Top computer includes a

Wunderbuss I/O Controller Board
Decision I (MPZ80) CPU
MM65K Memory Board
Disk Jockey Model 2D/B Floppy Disk Controller
(HDCA-3 Winchester Hard Disk Controller Board)

For a full description of these products, the user is referred to the technical manuals.

Table D-1: Wunderbuss I/O Controller Board:

<u>Switch 7C</u>			<u>Switch 10A</u>		
OFF	ON		OFF	ON	
	==	1		==	1
	==	2	==		2
==		3		==	3
	==	4		==	4
	==	5	==		5
==		6		==	6
==		7	==		7
==		8	==		8

Jumpered Settings:

J1 - not installed
J2 - A to B
J3 - installed
J4 - no jumpers
J5 - battery (user supplied)
J6 - to front panel RESET switch

Table D-2: Decision I (MPZ80) CPU:

<u>Switch 16D</u>			
Floppy Disk		Hard Disk*	
OFF	ON	OFF	ON
==		==	1
==		==	2
==		==	3
==		==	4
==		==	5
==		==	6
==		==	7
	==	==	8

*Optional: These settings allow system to be booted from the hard disk once it is initialized; procedure explained on page 15 of the **Decision CPU Technical Manual**.

Table D-3: MM65KS Memory Board:

<u>Switch 1C</u>		<u>Switch 5D</u>	
OFF	ON	OFF	ON
	==	==	1
	==	==	2
	==		3
	==	==	4
	==	==	5
	==		6
	==	==	7
	==	==	8

Switches set to enable extended addressing. Chip 2D not installed; chip 1D installed.

Jumpered Settings:

J1 - installed
 J2 - installed
 J3 - not installed
 J4 - installed
 J5 - not installed
 J6 - installed
 J7 - not installed

Table D-4: Disk Jockey 2D/B Floppy Disk Controller:

<u>Switch 5D</u>			<u>Switch 13C</u>		
OFF	ON		OFF	ON	
==		8	==		8
	==	7	==		7
==		6	==		6
==		5	==		5
==		4	==		4
==		3	==		3
==		2	==		2
==		1	==		1

Note that in some systems these switches were installed such that the top paddles are labeled "1" and the last paddles "8." In the event that your DJ2D/B has been constructed this way, all paddles are OFF except paddle 2 on Switch 5D, which is ON.

Jumpered Settings:

J2 - installed
J4 - jumpered A to B

Table D-5: HDCA-3 Winchester Hard Disk Controller:
(Users with hard disks only)

Switch 8C

OFF	ON	
	==	1
==		2
	==	3
==		4
	==	5
	==	6
	==	7
	==	8

Jumpered Settings:

A to VI0
B to VI1

Seek Complete Plugs:

P3 - jumpered 7 to 8
P4 - jumpered 7 to 8
P5 - jumpered 7 to 8

APPENDIX E

Sector Check

Ideally, no bad sectors were found in your hard disk during the diagnostic test. But if there were, these sectors are mapped out of the system and placed in a special CP/M file.

The diagnostic programs included on your system floppy diskette contain a BAD.DOC program. The routine, GETBAD, described within this document, reads the bad sector map that was setup by the FORMATHD program, then prints the information on the terminal. Another routine, FIXBAD, allocates the bad sector map to a special file. (There is also another routine called PUTBAD which allows the user to custom write his own bad sector map.)

The special file is referred to as USER 15 and makes a BADSPOT file, which is not normally displayed and will not appear in the file list when the CP/M directory (DIR) command is entered. It is only displayed when entered with the CP/M device status (STAT) command.

The following procedure will verify whether any bad sectors exist on your hard disk. Enter the following:

A> PIP

When this character appears,

*

enter a ^C sequence; the "A>" prompt returns in the PIP mode. Next enter

```
A> USER 15
A> SAVE 34 PIP.COM
A> PIP A:=A:STAT.COM[GØ]
A> STAT *.*
```

If bad sector areas do exist, the system returns a report of this in the following format:

Recs	Bytes	Ext	Acc
128	4k	1	R/O A:(BADSPOTS)*
68	12k	1	R/W A:PIP.COM
41	8k	1	R/W A:STAT.COM

Bytes remaining on A: nnK

*If this report is missing, or if there is any question about the integrity of your hard disk unit, run it through the diagnostic tests again. If you still result in problems, contact the Customer Service Center at Morrow Designs.